TIME TO COMPLETE NAVAL AIR TRAINING
AS AN ADDITIONAL CRITERION OF SUCCESS

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NAVAL AIR STATION
PENSACOLA FLORIDA

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TIME TO COMPLETE NAVAL AIR TRAINING AS AN ADDITIONAL CRITERION OF SUCCESS

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SUMMARY

The cadet who graduates from training relatively quickly is less expensive to train and conceivably could possess better flight proficiency than the cadet who is slow. This study investigated training time of successful cadets as a means of obtaining "purer" criterion groups for research purposes.

Results showed that 17.2 months were required for the average successful cadet of fiscal 1951 to complete training. The typical class had a range of seven months between graduation of its "slowest" and "fastest" cadet. The variability in training time among successful cadets appears to be large enough for its adoption as a criterion measure.

The question of the validity of such a criterion, however, must be demonstrated. In order to show this, data relevant to flight, ground instruction, and leadership performance were analyzed. The flight jackets for the 47 cadets who completed training in 15 months were compared on these variables with those for the 50 cadets who required 20 or more months to complete. These two groups represented the fastest and slowest 5 percent of the total successful sample with respect to training time. Analysis showed that cadets who are slow to complete training are characterized by generally poor performance, particularly with respect to flight proficiency. The fast group of cadets was superior to the slow on over-all flight performance, basic and advanced flight ratings, and total number of flights required to complete basic and advanced training. The fast group of cadets also had fewer unsatisfactory flights in basic and advanced training, fewer board actions taken, and fewer accidents throughout training. All these differences were statistically significant.

The fast group was consistently superior to the slow in flight performance throughout the different training phases, although the difference between the two groups in certain instruction and leadership ratings had disappeared during the advanced training phase.

Further follow-up on these 97 selected cadets for their fleet performance is recommended. If the slow group of cadets continue to show significantly poor flight performance, it would seem advisable to fail them during training.

For purposes of research, it is recommended that successful cadets who require 20 or more months to complete training be eliminated from the pass group when used as criterion. It is apparent from the results reported here that their flight performance is similar to the cadet group who have failed.

A special report is currently being prepared in which training implications from this study will be presented.

TECHNICAL SUPPORTING DATA .....

INTRODUCTION*

Criterion development is an important aspect of a research program since predictors can be no better than the criteria against which they were validated. One frequently used method for test validation is the comparison of the test performance of a group which has completed training versus the performance of a group terminating training either by failure, voluntary withdrawal, or other causes. This method is useful primarily because termination from training is a critical evaluative decision. Furthermore, termination by failure of an individual from training represents an over-all judgment of extremely poor performance. However, it identifies only the individuals at the low end of the distribution of talent. Thus, pass-fail criterion groups, while useful, represent relatively crude distinctions.

Some dissatisfaction with pass-fail criterion groups has long been recognized. However, it is a considerable problem to secure techniques whereby finer discriminations in performance may be made. Various performance ratings such as grades are often assigned individuals in training programs and sometimes are very useful for criterion refinement. Because of problems of reliability and validity, however, they are sometimes suspect or difficult to obtain.

In a few situations, training time itself may be a useful means of refining the pass criterion group. For example, in Naval Air Training, the cadets are assigned to classes for ground school, and then proceed at an individual rate through flight training. From previous experience it is estimated that approximately 18 months are required for a cadet to receive his wings. Since progress beyond ground school in the flight phase varies from cadet to cadet, the question arises as to the variability present in training time among successful cadets. There would seem to be many accidental reasons that might cause cadets to be slow in completing training. However, it seems reasonable to believe that cadets who complete training quickly would be characterized by good ability, strong motivation, or both. If this hypothesis is borne out, we have a simple, objective means of purifying the criterion of success in training.

This study, then, is part of our attempt to purify pass-fail criterion groups. The extent of variability in training time among successful cadets must be large enought to be useful. Furthermore, recommendations for purifying criterion groups may be made only if training time is related to performance as a Naval Aviator in a systematic fashion. To the extent that other training programs allow for individual variation in time to complete, the findings may be of general methodological interest.

METHOD

This study was performed on classes 14-50 through 14-51, a total of 26 classes and 988 successful cadets. These classes were the latest for

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* The writer wishes to express his appreciation for the valuable suggestions given by Dr. W. B. Webb throughout this study.

which sufficient time had elapsed so that their members would have had an opportunity to graduate.

Training time was determined by subtracting the date of entry into training from the date commissioned. Training time was rounded to the nearest month; less than 15 days were disregarded, 15 or more days were counted as an extra month. A total frequency distribution was made from the separate distributions of the 26 classes since the distributions of time for the separate classes were fairly comparable.

The flight jackets of extremely fast and slow cadets were selected for special study as a means of determining whether late completion was also characterized by poor performance. The fast cadet group included the 47 students who completed training in 15 months; the slow group included the 50 students who completed training in 20 or more months. These 97 cadets represent about 10 percent of the total graduate population of fiscal 1951.

The data from the flight jackets selected for comparative purposes included: over-all flight grades, ground school grades, flight grades, officer-like quality ratings, delinquency reports, total number of flights, number of unsatisfactory flights, number of boards, and number of accidents. Wherever possible, these variables were studied separately for pre-flight, basic, and advanced training stages. ACT and MCT scores, measures of scholastic and mechanical aptitude respectively, were also available from the flight jackets. Appropriate statistical tests were applied in order to compare the performance of the fast and slow cadet groups on the above variables. In most comparisons, this involved the use of student's "t" test for testing the significance of mean differences.

RESULTS

The average successful cadet for fiscal 1951 required 17.2 months to finish Naval Air Training (Table I). The standard deviation for the distribution of months of training was 1.3 months. A breakdown for each of the 26 classes investigated showed that the typical class had a range of seven months between graduation of its slowest and fastest cadet. However, 82 percent of the cases completed within a three month period (16 to 18 months).

In general, variability in training time among successful cadets is not pronounced, although the magnitude is sufficient for its use as a measurable variable.

The next question concerned differences in ability between fast and slow cadets. Flight jacket data were tested for significance of differences and these results are summarized in Tables II, III and IV. The flight jacket variables were classified into three major headings: flight, ground instruction, and leadership performance.

The fast group of cadets was significantly superior in all variables classified under the heading of flight performance (Table II). Not only were these differences statistically significant, but many were so large

that there was relatively little overlap between the two groups (Table V). Furthermore, the superiority of the fast group in flight performance was maintained throughout the training cycle. This was evidenced by better performance in advanced training as well as basic for the fast cadets on flight instruction; they also had fewer unsatisfactory flights, and fewer total flights required to complete advanced training.

Throughout the training cycle, there were about 14 times as many board actions for the slow group as the fast. The slow group produced slightly over four times as many accidents as the fast group. Both these comparisons show significant differences, as tested by χ^2.

These data offer striking evidence that extremely slow training time is characterized by extremely poor flight performance.

The slow group is also characterized by significantly poorer performance than the fast group in ground instruction during pre-flight and basic training phases (Table III). However, during advanced training the two groups do not differ significantly in ground instruction performance. The two groups also do not differ significantly with respect to scholastic and mechanical aptitude as measured by the Aviation Classification Test and the Mechanical Comprehension Test. However, the fast group is practically always characterized by better performance on all variables, including those such as the ACT and MCT, although statistical significance is not attained. It should be recalled that the ACT and MCT tests are used for selection, and cadets with low scores on these variables do not enter training. Consequently, the failure of these tests in predicting training time itself is only relative. This is particularly true since cadets who complete training quickly are superior to the slow group on these two variables, approaching statistical significance in the case of the Mechanical Comprehension Test.

With respect to military leadership as shown on officer-like-quality ratings, the slow group is characterized by significantly lower ratings during pre-flight and basic training phases (Table IV). During advanced training, however, the difference between the two groups on leadership ratings is not statistically significant. Delinquency reports are given to cadets for such conduct as being late for formation, failure to salute an officer, untidy rooms, and the like. They have been included in the leadership realm, although they may not be unequivocally placed in this category. The slow group is characterized by more delinquency reports during pre-flight and basic training stages, but the difference is significant only at the 5 percent level of confidence during the latter training phase. No delinquency reports were given to either group during advanced training.

The mean scores for many of the flight jacket variables have been placed in standard score form, with the mean equal to 50. On this basis, it can be seen (Tables II, III and IV) that the slow group is further below average on most variables studied than the fast group is above average. For example, on over-all flight performance, the mean rating for the fast group was 53.34 as compared to a mean of 44.11 for the slow group.

The frequency distributions presented in Table V highlight the differences between the fast and slow cadet groups on selected flight performance variables. For example, in over-all flight performance ratings 84 percent of the slow group receive standard scores below 44, whereas only 25.5 percent of the fast group receive scores below this value. On this same variable, 40 percent of the slow group receive standard scores of 39 or lower while none of the fast group are in this interval. Results of this kind show strikingly the extremity of performance differences between fast and slow cadets.

DISCUSSION

At the outset of this research it was felt that fast cadets would show superior performance, but that slow cadets would not necessarily be characterized by poor performance. This belief was held because of the apparent importance of many possible accidental factors such as health or weather which might cause a cadet to be slow. The results indicate, however, that such accidental factors are relatively unimportant in causing a cadet to be slow. Rather, slow performance generally is characterized by less adequate performance.

This study has dealt with total training time, but it would be important to check whether the cadet who is very slow during basic training is also slow during advanced and perhaps, more critically, in the fleet itself. The chances appear good that such a relationship will be found based on the poor flight performance shown in advanced training by the slow group. However, the strength of this relationship should be determined since completion of basic training itself is often used as a criterion of success.

During the advanced training stages, it will be recalled that ground instruction and military leadership ratings did not differentiate the fast and slow groups. Aside from the possibility that ratings on these variables are not so meaningful in advanced as earlier training phases, there are two other important possibilities. Cadets who are poor in flight performance during basic training may be failed if they have not shown improvement in leadership and ground instruction performance during that time. Board officers may be inclined to retain the cadet who compensates for poor flight performance. Selective drop-out on this basis may account for the failure to find differences in advanced. The other major possibility is that actual improvement in leadership and ground instruction performance has occurred for all cadets. Further investigation to discover which of these two possibilities is most likely is worthwhile.

The analysis in this report was based on extreme cases, about 5 percent of the total sample in each of the fast and slow groups. It is not feasible to use only those few cadets who complete training in 15 months as the criterion group. However, if it may be assumed that training time is a linear function of success, we can make recommendations for purifying criterion groups. The larger the successful sample of cadets that are available, the more we can refine the successful group. From the data

presented here, cadets who take 20 or more months to complete training should be eliminated from the criterion group. If the sample of successful cadets is large enough to permit, it is recommended that cadets who complete in 19 months also be eliminated. From Table I, it is estimated that elimination from the successful group of those cadets who require 19 or more months of training time should reduce the criterion sample by about 10 percent. Thus, this refinement is a practical one.

The weaker the relationship between the predictor and pass-fail criterion, the greater is the need for eliminating cases of this kind. If these cases were included, significant correlations can be found, but they would become more significant by elimination of the extremely slow cadets. The danger from their inclusion is that they may vitiate a significant correlation.

Implicit throughout this discussion has been the acceptance of flight jacket data as evidence for validity. The question arises as to why these data alone might not be a more direct means of criterion refinement. This possibility itself is being currently evaluated in other research studies by other investigators. Eventually, performance ratings themselves may serve as a criterion purification technique. In the interim the importance and objectivity of training time makes it an intriguing variable for further study. The importance of the time variable in Naval Air Training may encourage investigators elsewhere to explore its utility.

TABLE I

TIME TO COMPLETE PROGRAM
CLASSES 14-50 THROUGH 14-51

(N = 988)

Number of Months	Frequency
15	47
16	233
17	366
18	223
19	69
20	30
21	13
22	3
23	1
24	3
	N = 988

Mean = 17.2 Months

Standard Deviation = 1.3 Months

Range = 10.0 Months

TABLE II

COMPARISON OF FAST AND SLOW CADET GROUPS
ON FLIGHT PERFORMANCE VARIABLES

		Fast Group (N=47)		Slow Group (N=50)		
	Variable	Mean	S.D.	Mean	S.D.	"t"
1.	Over-all Flight Grade	53.3	6.9	44.1	7.5	6.24*
2.	Basic Flight Instruction	50.7	8.3	39.2	6.1	7.68*
3.	Advanced Flight Instruction	53.5	8.1	43.6	7.0	6.39*
4.	Total Flights Basic	146.6	9.7	165.3	9.9	9.29*
5.	Total Flights Advanced	51.9	23.5	76.6	18.8	5.65*
6.	Unsatisfactory Flights Basic	1.5	1.2	5.9	2.7	9.93*
7.	Unsatisfactory Flights Advanced	0.6	1.0	2.2	2.0	5.00*
8.	Number of Accidents (Throughout training)	3		13		---- **
9.	Number of Boards (Throughout training)	5		72		---- **

* t significant beyond 1 percent level of confidence.

** χ^2 significant beyond 1 percent level of confidence.

TABLE III

COMPARISON OF FAST AND SLOW CADET GROUPS
ON GROUND INSTRUCTION VARIABLES

		Fast Group (N=47)		Slow Group (N=50)		
	Variable	Mean	S.D.	Mean	S.D.	"t"
1.	Ground Instruction Pre-Flight	52.5	6.4	45.7	8.6	4.38*
2.	Ground Instruction Basic	51.5	9.1	45.9	10.5	2.79*
3.	Ground Instruction Advanced	50.5	8.9	49.4	9.4	0.56
4.	Aviation Classification Test	86.7	9.9	85.3	11.5	0.63
5.	Mechanical Comprehension Test	60.8	7.1	58.2	8.0	1.66

* t significant at the 1 percent level of confidence.

TABLE IV

COMPARISON OF FAST AND SLOW CADET GROUPS
ON LEADERSHIP VARIABLES

		Fast Group (N=47)		Slow Group (N=50)		
	Variable	Mean	S.D.	Mean	S.D.	"t"
1.	OLQ° Ratings, Pre-Flight	55.8	5.7	53.0	5.3	2.48**
2.	OLQ° Ratings, Basic	50.7	7.4	46.1	8.4	2.79*
3.	OLQ° Ratings, Advanced	53.5	7.0	54.6	7.5	1.80
4.	Delinquency Reports, Pre-Flight	1.9	1.6	2.5	2.4	1.41
5.	Delinquency Reports, Basic	1.9	1.4	2.6	2.2	2.03**

°OLQ = Officer-Like-Quality

* t significant at the 1 percent level of confidence.

** t significant at the 5 percent level of confidence.

TABLE V

COMPARISON OF SLOW AND FAST CADET GROUPS
ON SELECTED FLIGHT PERFORMANCE RATINGS

Standard Score Rating	Over-all Flight Grade		Basic Flight Instruction		Advanced Flight Instruction	
	Slow	Fast	Slow	Fast	Slow	Fast
25 - 29	0	0	1	0	1	0
30 - 34	3	0	9	0	5	0
35 - 39	17	0	15	3	10	1
40 - 44	8	5	17	9	15	7
45 - 49	8	8	4	12	11	8
50 - 54	9	15	3	10	5	10
55 - 59	4	9	1	6	2	8
60 - 64	1	7	0	4	1	10
65 - 69	0	2	0	2	0	2
70 - 74	0	1	0	1	0	0
75 - 79	0	0	0	0	0	1
	N = 50	47	50	47	50	47